



SECTION D5000 GENERAL ELECTRICAL REQUIREMENTS

- 1.0 APPLICATION OF THIS CHAPTER
- 2.0 CODES AND STANDARDS
 - 2.1 GENERAL REQUIREMENTS
 - 2.2 WORK SMART STANDARDS (WSS)
 - 2.3 LANL DOCUMENTS
 - 2.4 DOE (SELECTED ORDERS)
 - 2.5 BUILDING AND ELECTRICAL CODES
 - 2.6 IEEE (INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS)
 - 2.7 ASHRAE (AMERICAN SOCIETY OF HEATING, REFRIGERATION, AND AIR CONDITIONING ENGINEERS)
 - 2.8 IESNA (ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA)
 - 2.9 NFPA (NATIONAL FIRE PROTECTION ASSOCIATION)
 - 2.10 NECA (NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION)
 - 2.11 TIA/EIA (TELECOMMUNICATIONS INDUSTRY ASSOCIATION/ELECTRONICS INDUSTRIES ASSOCIATION)

3.0	COORDINATION OF DESIGN REQUIREMENTS
3.1	GENERAL
3.2	SITE UTILITIES
3.3	SPECIAL SYSTEMS
4.0	DESIGN DOCUMENTATION
4.1	CALCULATIONS
4.2	DRAWINGS
4.3	CONSTRUCTION SPECIFICATIONS
4.4	SEALING CONSTRUCTION DOCUMENTS
5.0	SYSTEM REQUIREMENTS
5.1	WORKING SPACES
5.2	ENERGY CONSERVATION
5.3	SUSTAINABLE DESIGN
5.4	STANDARDS FOR MATERIAL AND EQUIPMENT
5.5	OPERATING ALTITUDE
5.6	LIGHTNING
5.7	POWER SYSTEM RELIABILITY
5.8	POWER SYSTEM HARMONIC LIMITS
5.9	ADEQUACY AND FUTURE EXPANSION
5.10	FAULT CURRENT CAPACITY
5.11	SELECTIVE COORDINATION
5.12	POWER QUALITY
6.0	EQUIPMENT LOCATION
6.1	GENERAL
6.2	EQUIPMENT ROOMS AND SPACES
7.0	ELECTRICAL IDENTIFICATION
7.1	COMPONENT IDENTIFICATION
7.2	ELECTRICAL COMPONENT IDENTIFICATION TAGS
7.3	EQUIPMENT NAMEPLATES
7.4	VOLTAGE MARKERS
7.5	WARNING SIGNS
7.6	ARC-FLASH WARNING LABELS
7.7	EMERGENCY SYSTEM IDENTIFICATION
7.8	OUTLET LABELS
7.9	WIRE MARKERS
7.10	WORKING SPACE MARKERS
7.11	DIAGRAMS AND OPERATING INSTRUCTIONS
8.0	ELECTRICAL SUPPORTS AND ANCHORAGE
9.0	RODENT - PROOFING
10.0	DEMOLITION

- 11.0 ACCEPTANCE TESTING
 - 11.1 GENERAL
 - 11.2 LARGE PROJECTS
 - 11.3 SMALL PROJECTS
- 12.0 SPECIAL REQUIREMENTS FOR NUCLEAR FACILITIES

SECTION D5010 ELECTRICAL SERVICE & DISTRIBUTION

- 1.0 MEDIUM-VOLTAGE SERVICE & DISTRIBUTION SYSTEMS
 - 1.1 UTILITY DISTRIBUTION SYSTEM CHARACTERISTICS
 - 1.2 UTILIZATION SYSTEM CHARACTERISTICS
 - 1.3 INDOOR MEDIUM-VOLTAGE SWITCHGEAR
 - 1.4 INDOOR MEDIUM-VOLTAGE POWER TRANSFORMERS
 - 1.5 MEDIUM-VOLTAGE POWER CABLE
 - 1.6 RACEWAY SYSTEMS FOR MEDIUM-VOLTAGE CABLES
 - 1.7 MEDIUM-VOLTAGE METERING
- 2.0 LOW-VOLTAGE SERVICE & DISTRIBUTION SYSTEMS
 - 2.1 SYSTEM CHARACTERISTICS
 - 2.2 BUILDING SERVICE POINT LOCATION
 - 2.3 DISCONNECTING MEANS
 - 2.4 METERING
 - 2.5 SURGE PROTECTION
 - 2.6 SWITCHGEAR, SWITCHBOARDS, POWER PANELBOARDS
 - 2.7 LIGHTING & APPLIANCE BRANCH CIRCUIT PANELBOARDS
 - 2.8 LOW-VOLTAGE DRY-TYPE TRANSFORMERS
 - 2.9 GROUNDING
 - 2.10 RACEWAY SYSTEMS
 - 2.11 CONDUCTORS

SECTION D5020 LIGHTING & BRANCH CIRCUIT WIRING

- 1.0 RACEWAY AND BOXES
 - 1.1 RACEWAYS
 - 1.2 FLEXIBLE CONDUIT
 - 1.3 BOXES
- 2.0 CONDUCTORS AND CABLES
 - 2.1 WIRING COLOR CODES
 - 2.2 BUILDING WIRE AND CABLE
 - 2.3 REMOTE CONTROL WIRING
 - 2.4 METAL-CLAD CABLE
 - 2.5 FLEXIBLE CORD AND CABLE

3.0	WIRING DEVICES
3.1	RECEPTACLE OUTLETS
3.2	RECEPTACLE PLATES
4.0	WIRING CONNECTIONS
4.1	GENERAL
5.0	MOTORS AND MOTOR CONTROLLERS
5.1	MOTOR CONTROLLERS
5.2	MOTOR CONTROL CENTERS
5.3	ADJUSTABLE FREQUENCY AC CONTROLLERS
5.4	MANUAL STARTERS
5.5	MOTOR DISCONNECTING MEANS
5.6	MOTOR CONNECTIONS
5.7	MOTORS
6.0	GROUNDING
6.1	ENCLOSURE AND EQUIPMENT GROUNDING
6.2	ISOLATED GROUNDING SYSTEM
6.3	SIGNAL REFERENCE GRID
6.4	CONTROL OF STATIC ELECTRICITY
7.0	INTERIOR LIGHTING
7.1	DESIGN
7.2	LUMINAIRES AND LAMPS
7.3	LIGHTING CONTROL
7.4	INSTALLATION
8.0	EXIT AND EMERGENCY LIGHTING
8.1	GENERAL
8.2	EMERGENCY LIGHTING UNIT EQUIPMENT
8.3	LED EMERGENCY EXIT SIGNS
8.4	SELF-LUMINOUS EXIT SIGNS
9.0	EXTERIOR BUILDING LIGHTING
9.1	SELECTION
9.2	CONTROL
9.3	INSTALLATION

SECTION D5030 COMMUNICATIONS & SECURITY

1.0	OPEN TELECOMMUNICATIONS SYSTEMS
1.1	DEFINITIONS
1.2	GENERAL
1.3	TELECOMMUNICATIONS ROOMS
1.4	SERVER EQUIPMENT ROOMS
1.5	TELECOMMUNICATIONS GROUNDING

1.6	WORK AREA OUTLETS
1.7	TELECOMMUNICATIONS HORIZONTAL PATHWAYS
1.8	FURNITURE PATHWAYS
1.9	BACKBONE AND ENTRANCE PATHWAYS
1.10	TELECOMMUNICATIONS CABLES
2.0	PROTECTED TRANSMISSION SYSTEMS
2.1	GENERAL
2.2	DEFINITIONS
2.3	PTS TOPOLOGY
2.4	RED TELECOMMUNICATIONS ROOMS
2.5	RED SERVER EQUIPMENT ROOM(S)
2.6	PTS TERMINAL CONNECTIONS
2.7	PTS HORIZONTAL PATHWAYS
2.8	PTS BACKBONE AND ENTRANCE PATHWAYS
2.9	PTS CABLES
2.10	IDENTIFICATION
3.0	VOICE PAGING SYSTEMS
3.1	GENERAL
3.2	DESIGN PARAMETERS
3.3	SPEAKER PLACEMENT
3.4	SPEAKER WIRING
3.5	SPEAKER RACEWAYS AND ENCLOSURES
3.6	PAGING AMPLIFIERS (FURNISHED BY THE LANL TELECOMMUNICATIONS GROUP)
3.7	ACCEPTANCE TESTING
4.0	CATV (LABNET) SYSTEMS
4.1	GENERAL
4.2	SYSTEM TOPOLOGY
4.3	WORK AREA OUTLETS/CONNECTORS
4.4	TELEVISION SYSTEM RACEWAYS
4.5	COAXIAL CABLE (GFE)
5.0	SECURITY WARNING LIGHT SYSTEM
5.1	GENERAL
5.2	SYSTEM DESIGN
6.0	FIRE ALARM SYSTEM
6.1	GENERAL
6.2	FUNCTIONAL REQUIREMENTS FOR ADDRESSABLE SYSTEMS
6.3	SYSTEM DESIGN AND DOCUMENTATION
6.4	INSTALLATION
6.5	ACCEPTANCE TESTING AND INSPECTION

7.0	ADMINISTRATIVE ACCESS CONTROL SYSTEM
7.1	GENERAL
7.2	SYSTEM DESIGN
8.0	PHYSICAL SECURITY SYSTEM
8.1	GENERAL
8.2	CONDUIT
8.3	BOXES
8.4	CABLES
8.5	ELECTRIC DOOR STRIKES
8.6	SECURITY SERVICE ENTRANCE
8.7	FIELD PANEL INSTALLATION
8.8	ROUGH-IN FOR RAPS
8.9	ROUGH-IN FOR TURNSTILES
8.10	ROUGH-IN FOR MOTION DETECTORS

SECTION D5090 OTHER ELECTRICAL SYSTEMS

1.0	GENERAL
2.0	ENGINE-GENERATOR SYSTEMS
2.1	GENERAL
2.2	MINIMUM RATING
2.3	ENERGY SOURCE
2.4	TRANSFER SWITCH
2.5	STARTING SYSTEM
2.6	REMOTE ANNUNCIATION
2.7	NOISE CONTROL
2.8	SEISMIC
2.9	LOAD BANK
2.10	GENERATOR OUTPUT
2.11	GROUNDING
2.12	ACCEPTANCE TESTING
3.0	UPS SYSTEMS
3.1	GENERAL
3.2	UPS SELECTION
3.3	UPS SURVIVABILITY
3.4	UPS CONFIGURATION
3.5	UPS INSTALLATION
3.6	BUILDING AUXILIARY SYSTEMS
3.7	UPS SYSTEM ACCEPTANCE TESTING AND INSPECTION

4.0	STATIONARY BATTERY POWER SYSTEMS
4.1	GENERAL
4.2	BATTERY POWER SYSTEM SURVIVABILITY
4.3	BATTERY POWER SYSTEM CONFIGURATION
4.4	INSTALLATION
4.5	BATTERY SYSTEM ACCEPTANCE TESTING AND INSPECTION
5.0	CABLE TRAY SYSTEMS
5.1	CABLE TRAY SELECTION
5.2	CABLE TRAY INSTALLATION
5.3	CABLE TRAY GROUNDING
5.4	CABLE INSTALLATION
5.5	CABLE TRAY LABELING
6.0	SIGNAL REFERENCE GRID
7.0	LIGHTNING PROTECTION SYSTEMS
7.1	CRITERIA
7.2	GROUNDING SYSTEM
7.3	MATERIALS
7.4	INSTALLATION
7.5	SURGE PROTECTION
7.6	ACCEPTANCE INSPECTION

SECTION G4010 SITE ELECTRICAL DISTRIBUTION

1.0	INTRODUCTION
1.1	SCOPE
1.2	INTENT
2.0	CODES AND STANDARDS
2.1	GENERAL REQUIREMENTS
2.2	AMERICAN SOCIETY OF CIVIL ENGINEERS
2.3	EDISON ELECTRIC INSTITUTE
2.4	FEDERAL REGULATIONS
2.5	INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)
2.6	INSULATED CABLE ENGINEERS ASSOCIATION
2.7	US DEPARTMENT OF AGRICULTURE
3.0	GENERAL SYSTEM CHARACTERISTICS
3.1	SYSTEM OPERATING VOLTAGES
3.2	BASIC IMPULSE LEVEL (BIL)
3.3	SYSTEM GROUNDING
4.0	DESIGN DOCUMENTATION
4.1	CALCULATIONS
4.2	DRAWINGS

5.0	OVERHEAD LINES
5.1	GENERAL
5.2	CLEARANCES, GENERAL REQUIREMENTS
5.3	CLEARANCE ABOVE GROUND
5.4	CLEARANCE BETWEEN WIRES, CONDUCTORS, AND CABLES CARRIED ON DIFFERENT SUPPORTING STRUCTURES
5.5	CLEARANCE OF WIRE, CONDUCTORS, CABLES, AND ENERGIZED EQUIPMENT FROM OTHER STRUCTURES
5.6	GRADES OF CONSTRUCTION
5.7	LOADING
5.8	SLACK SPANS
5.9	STRENGTH REQUIREMENTS
5.10	POLE EMBEDMENT DEPTH REQUIREMENTS
5.11	OVERHEAD SECONDARY LINES (480V AND BELOW) INCLUDING SERVICE DROPS
6.0	UNDERGROUND CONSTRUCTION
6.1	CABLE
6.2	DUCT BANKS
6.3	MANHOLES
6.4	RODENT-PROOFING
6.5	UNDERGROUND SECONDARY LINES (480V AND BELOW) INCLUDING SERVICE DROPS
7.0	PADMOUNT SWITCHES
7.1	DESCRIPTION
7.2	APPLICATION
7.3	INSTALLATION
7.4	CLEARANCES
8.0	METAL-ENCLOSED SWITCHGEAR
8.1	DESCRIPTION
8.2	APPLICATION
9.0	METAL-CLAD SWITCHGEAR
9.1	DESCRIPTION
9.2	EQUIPMENT
9.3	APPLICATION
10.0	MEDIUM-VOLTAGE TRANSFORMERS
10.1	GENERAL
10.2	TRANSFORMER SELECTION
10.3	TRANSFORMER CAPACITY
10.4	TRANSFORMER LOCATION
10.5	OVERCURRENT PROTECTION

11.0	UNIT SUBSTATIONS
11.1	DESCRIPTION
11.2	EQUIPMENT
11.3	APPLICATION
12.0	FUSING
12.1	GENERAL
13.0	LIGHTNING PROTECTION
13.1	OVERHEAD TRANSMISSION LINES
13.2	OVERHEAD DISTRIBUTION LINES
13.3	CABLE RISERS AND POLE-MOUNTED EQUIPMENT
13.4	PADMOUNT EQUIPMENT
14.0	PRIMARY METERING
14.1	APPLICABILITY
14.2	METERING EQUIPMENT
15.0	GROUNDING
15.1	OVERHEAD LINES
15.2	UNDERGROUND LINES
15.3	SERVICES
16.0	RIGHTS-OF-WAY
16.1	OVERHEAD 13.2kV DISTRIBUTION
16.2	OVERHEAD 115kV TRANSMISSION
16.3	UNDERGROUND 13.2kV DISTRIBUTION
16.4	SEPARATION FROM OTHER UNDERGROUND UTILITIES
17.0	JOINT USE
17.1	APPLICATION
17.2	JOINT USE AGREEMENT
17.3	CONSIDERATIONS
18.0	ENVIRONMENTAL PROTECTION
18.1	EPA REGULATIONS AND SPCCs
18.2	SCOPE OF AN SPCC PLAN
18.3	FACILITIES AFFECTED BY EPA REGULATIONS
18.4	OIL CONTAINMENT
19.0	WILDLIFE PROTECTION
19.1	MITIGATION TECHNIQUES

SECTION G4020 SITE LIGHTING

1.0	CRITERIA
1.1	GENERAL
1.2	EXTERIOR LIGHTING
1.3	ROADWAY LIGHTING

- 1.4 PEDESTRIAN WALKWAY LIGHTING
- 1.5 PARKING FACILITY LIGHTING
- 1.6 SECURITY LIGHTING
- 1.7 CALCULATIONS
- 2.0 LUMINARIES
 - 2.1 GENERAL
 - 2.2 SITE LUMINARIES SCHEDULES
- 3.0 POLES
- 4.0 WIRING AND CONDUIT
 - 4.1 CONDUIT
 - 4.2 WIRING
 - 4.3 GROUNDING
- 5.0 SITE LIGHTING CONTROLS

SECTION G4030 SITE COMMUNICATIONS & SECURITY

- 1.0 OPEN TELECOMMUNICATIONS SYSTEMS
 - 1.1 DEFINITIONS
 - 1.2 GENERAL PLANNING AND DESIGN CONSIDERATIONS
 - 1.3 UNDERGROUND PATHWAYS
 - 1.4 AERIAL PLANT
 - 1.5 TELECOMMUNICATIONS CABLES
- 2.0 SITE PROTECTED TRANSMISSION SYSTEMS
 - 2.1 GENERAL
 - 2.2 DEFINITIONS
 - 2.3 PTS ENTRANCE PATHWAYS
 - 2.4 IDENTIFICATION
- 3.0 PHYSICAL SECURITY SYSTEM
 - 3.1 SECURITY SERVICE ENTRANCE
 - 3.2 SITE SECURITY SYSTEMS

SECTION G4090 OTHER SITE ELECTRICAL UTILITIES

- 1.0 CATHODIC PROTECTION
 - 1.1 GENERAL
 - 1.2 CP DESIGNER QUALIFICATIONS AND RESPONSIBILITIES
 - 1.3 CP DESIGN
- 2.0 SITE GROUNDING
 - 2.1 GENERAL
 - 2.2 GROUNDING ELECTRODE SYSTEM
 - 2.3 ENCLOSURE AND EQUIPMENT GROUNDING
 - 2.4 DUCT BANK GROUNDING
 - 2.5 FENCE GROUNDING